

The Vulnerability of Women to Climate Change in terms of Exposure, Sensitivity and Adaptive Capacity: the case study of North Gondar Zone

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Abstract:

This research is done to evaluate the vulnerability of women to climate change in some selected districts of North Gondar Zone. The IPCC vulnerability measures index were used to analyze the vulnerability level. As a result exposure index, adaptive capacity and sensitivity index with eight major component and thirty five sub-components were used to collect data from respondents. 346 randomly selected respondents were used to collect data from the three purposively selected agro-ecology zone districts. The result shows that there is high exposure level in Debark district (0.89) followed by Dembia (0.86) while the least is scored in West Belesa district (0.86). Regarding the adaptive capacity of districts Debark district scored the best result (0.3) and West Belesa district (0.2) is the least. Similarly the sensitivity level becomes higher for West Belesa (0.89) which shows the least coping mechanism by women and the highest result by Debark District (0.85). The vulnerability of the district is therefore compute by taking the weight of the three contributing factors together and calculated using IPCC formula. As a result of this the vulnerability level of the districts becomes 0.52 which lays on vulnerability categories according to IPCC vulnerability measures. The vulnerability measures of each district were also done using the same formula. Therefore the result shows that Debark District (0.52), Dembia District (0.5) and the highest score is West Belesa (0.59). The researcher conclude that women in the study area are highly vulnerable to climate change and among the contributing factors the value of Exposure and sensitivity indices are higher and adaptive capacity to climate change is the practice in the study districts.

Key Words: Vulnerability of women, climate change and adaptive capacity.

Background of the Study:

The impacts of climate change are different for different populations group, and are not a gender neutral phenomenon. The gender dimension of the climate change is gaining a greater profile in the global community today. The basic reason that needs to integrate the gender issues in to the policy, program and decision making process of climate change is that it has different impact for women and men.

Researches results reveal that women especially in developing countries are vulnerable to climate change that men. Women are highly dependent on local natural resources for their livelihood, responsible to securing water, food and fuel for cooking and heating for the family in these countries. Similarly, unequal access to all levels of policy and decision-making processes that makes women less able to influence policies, programs and decisions that impact their lives; socio-cultural norms that can limit women from acquiring the information and skills necessary to escape or avoid hazards are other cause that let women more venerable to climate change than men (UNDP, 2011).

The effects of climate change can be felt in the short-term through natural hazards, such as landslides, floods and hurricanes; and in the long-term, through more gradual degradation of the environment. The adverse effects of these events are already felt in many areas, including in relation to, inter alia, agriculture and food security; biodiversity and ecosystems; water resources; human health; human settlements and migration patterns; and energy, transport and industry (UN women watch, 2009).

In many of these contexts, women are more vulnerable to the effects of climate change than men—primarily as they constitute the majority of the world's poor and are more dependent for their livelihood on natural resources that are threatened by climate change.

The purpose of this paper is to investigate the vulnerability of women to climate change in some selected woreda of North Gondar Zone. The research explore the exposure of women to climate change, Measure the sensitivity of women to climate change and Identify the Adaptive capacity of women to climate change in North Gondar Zone.

Objectives:**General Objectives:**

The general objective of this research is to assess the Level of Women Vulnerability to Climate Change in North West of Ethiopia.

Specific Objectives:

Specifically this research has the tried to;

1. Explore the exposure of women to climate change in North Gondar Zone
2. Measure the sensitivity of women to climate change in North Gondar Zone
3. Identify the Adaptive capacity of women to climate change in North Gondar Zone

Methodology:**Research Design:**

A longitudinal research was employed to assess women vulnerability to climate through exposure, sensitivity and adaptive capacity mechanisms. This research was conducted in three selected Woreda of North Gondar Zone Namely; Dembia, Miherab Belesa and Debark woreda.

Both quantitative and qualitative research method were employed to assess Women Vulnerability to Climate change through Exposure, Sensitivity and Adaptive capacity mechanisms. Quantitative method helped to see the association, cause effect relationship of independent variable with dependent variable and key informant interview and FGD helped the researcher collected data related to institutional, collective issues of women vulnerability to climate

Sampling and sampling procedures:

Multistage sampling techniques were used to collect data. First, three target Woredas were purposively be selected from North Gondar zone administration namely; Mirab Belesa, Debark, and Dembia. In the second stage, a total of 9 sample Kebeles were purposively be selected from the entire three target Districts. In the third stage, 398 households were selected randomly from the target kebeles. These 398 sample households were divided Proportional to 9 kebeles using standardized scientific formula. The correct sample size is calculated using the formula:

$$n = \frac{N}{1 + N(e^2)}$$

Where: n = required sample size, e^2 = error limit, N = Total household (Source; Yamane 1967:258). Therefore taking into consideration the study theme, 5% of sampling error is suggested. Hence; the total numbers of households in the nine kebeles are:

$$n = \frac{68548}{1 + 68548(0.0025)}$$

Almost 398 sample respondents will be taken proportionally.

Variables:

Though different indicators are used by researchers to measure vulnerability, for this research, the three concepts used to measure vulnerability are exposure, sensitivity, and adaptive capacity (IPCC 2007).

Exposure indicators: For this study, the levels of exposure of women to climatic change are taken as change in temperature, rainfall, drought, wind, livelihood situations, food insecurity, and migration, shortage in water and energy source and transportation.

Sensitivity indicators: Deaths of family members and loss of properties (land, livestock, and crop) due to climate related disasters over a years; share of natural resource based income (agriculture, livestock, forest, honey, and handicraft) and non-natural based remunerative income (salaried job, remittance, skilled non-farm job) to total income and the socio-economic context – the level of poverty, the unemployment, or the access to basic services are taken as sensitivity indicators

Adaptive Capacity refers to “the ability of a system to adjust to climate change so as to moderate potential damage, take advantage of opportunities, or help cope with consequences” (IPCC 2007). This includes all the economic, social and physical adaptation of women to climate change vulnerability.

Data sources and collection instruments:

Both cloth and open ended questionnaire consisting of four parts were designed and distributed to households in the study areas. In addition, the researcher employed key informant interview with woreda agriculture sector experts and conduct FGD with Agriculture, water and energy, health, women and children office experts.

Data Analysis Procedure:

Following, data were analyzed using quantitative and qualitative analysis methods. The demographic profiles of the respondent were analyzed using simple statistical tools. Moreover, from the inferential statistical methods chi square, binary and multinomial logistic regressions were used. Chi squared test will be used to see the association of independent variable with dependent variable, and binary and multinomial logistic regressions analysis were employed to identify the cause-effect relationship the three variables.

Results and Discussion:

This research uses the IPCC vulnerability measure that focuses on women vulnerability in terms of the three indexes; Exposure, Sensitivity and Adaptive capacity. Exposure of the study population was measured by the number of natural disasters that have occurred in the past 6 years, while climate variability is measured by the average standard deviation of the maximum and minimum monthly temperatures and monthly precipitation over a 6-year period. Adaptive capacity was quantified by the demographic profile of a district, the types of livelihood strategies employed, and the strength of social networks. Last, sensitivity was measured by assessing the current state of a district's food and water security and health status.

The formula used to calculate the result of each indexes after identifying the weights of major component for each contributing factors is;

Where CI_d is the calculated exposure score for place d (equivalent to the Natural Disaster and Climate Variability major component), a_d is the calculated adaptive capacity score for district d (weighted average of the Socio-Demographic, Livelihood Strategies, and Social Networks major components), and s_d is the calculated sensitivity score for district d (weighted average of the Health, Food and Water major components).

and contributing factor (exposure, sensitivity, or adaptive capacity) for components for place d indexed by i, W_{Mi} is the weight of each major component, and n is the number of major components in each contributing factor. Once exposure, sensitivity, and adaptive capacity were calculated, the three contributing factors were combined using the following equation:

$$LVI - IPCC_d = (e_d - a_d) * s_d$$

Where $LVI - IPCC_d$ is the LVI for district d expressed using the IPCC vulnerability framework, e is the calculated exposure score for place d (equivalent to the Natural Disaster and Climate Variability major component), a is the calculated adaptive capacity score for district d (weighted average of the Socio-Demographic, Livelihood Strategies, and Social Networks major components), and s is the calculated sensitivity score for district d (weighted average of the Health, Food and Water major components).

Exposure Indexes:

Using Natural hazards and Climate variability as a major component for exposure index, and Temperature, Rainfall, flood, precipitation as elements in a major component the research analyzed the exposure level of the three districts. The figure shows the value of exposure index for the three districts where the maximum value is recorded in Debark District (0.89), followed by Dembia (0.86) and the least by West Belesa (0.86). Though the comparison in made regarding the scored result of the districts, the exposure to climate change is higher in areas.

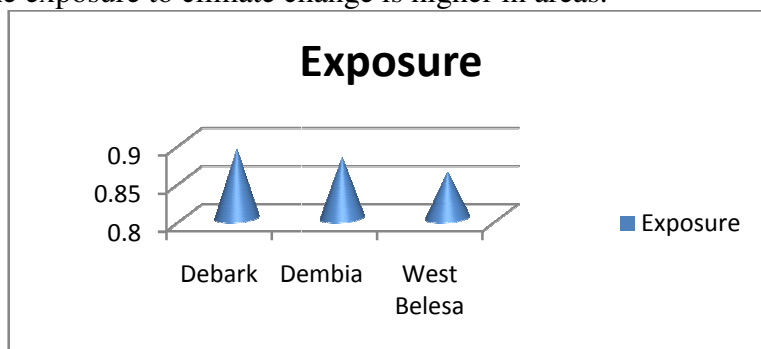


Figure1. Exposure Index For the three districts

Adaptive capacity Indices:

Unlike the two indexes, the adaptive capacity index measure the level of coping mechanism used by women to minimize the exposure and sensitivity of the climate change. For the exposure and sensitivity indices, the highest value always corresponds to the greatest vulnerability while for adaptive capacity; the highest value corresponds to the lowest vulnerability.

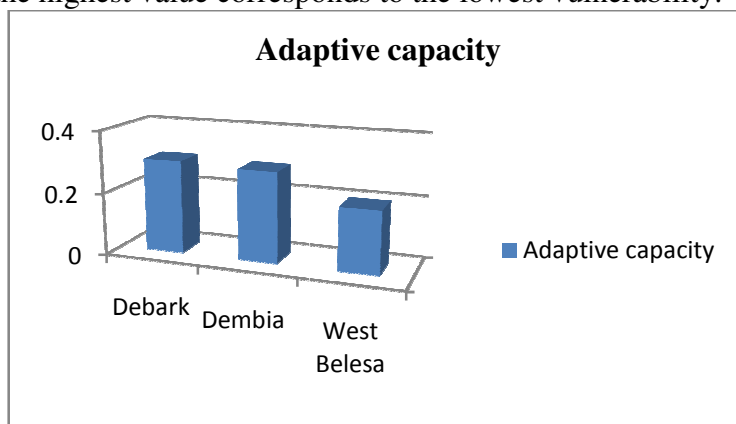


Figure 2, the value of adaptive capacity index for the three districts

Figure 2 shows the adaptive capacity of women to cope up to any climate change the challenges. The effort of women to mitigate climate changes through socio demographics, livelihood strategies and social network were included to measure the adaptive capacity index. As a result the least values are scored in all districts which show the least level of women to adapt the situation. From the districts still Debark district show a good effort (0.3), Dembia (0.29) and West Belesa (0.2).

Sensitivity Indices:

The sensitivity of women to climate change is measured through health vulnerability, food vulnerability and water security. Therefore based on the analysis using the sub and major component the values sensitivity index for the districts were presented below.

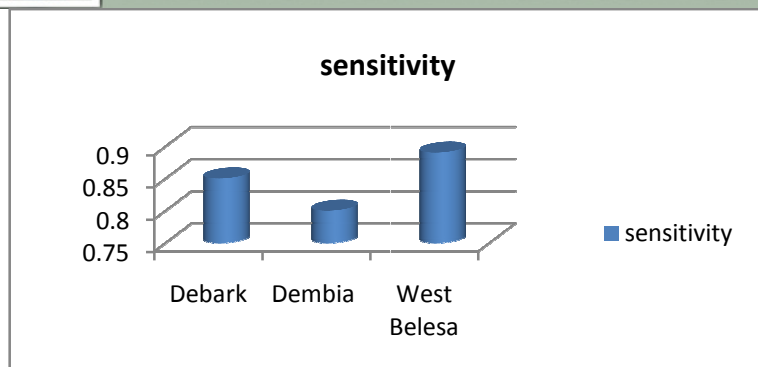


Figure 3,

the value of the sensitivity index for the three districts

As illustrated in Figure 3, the sensitivity index value is the highest score. Women are vulnerable to water scarcity, shortage of food, fuel and some sort of health problems as a result of climate change. In this regard women are sensitive to climate change by 0.89 in West Beles District, 0.85 in Debark district and 0.8 at Dembia district.

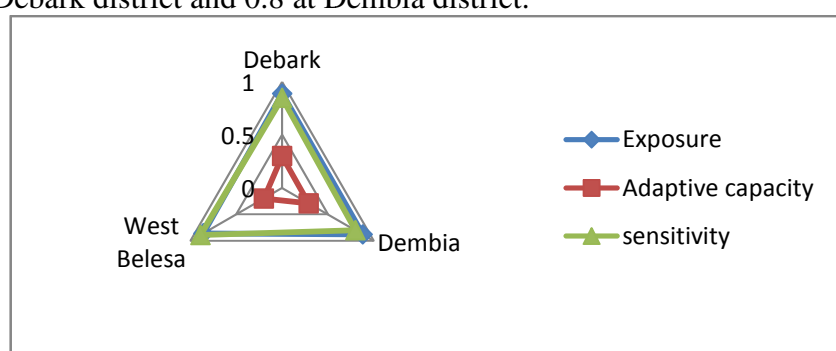


Figure 4, the value of three indices for the three districts

The result in figure 4 shows the value of the three contributing factors (Exposure, sensitivity and Adaptive capacity) indices for the three districts. The values of the indices for the districts are higher in exposure and sensitivity but least in adaptive capacity. The exposure level score is highest for Debark District while the sensitivity is significantly high in West Belesa District.

Vulnerability index of districts:

To measure the vulnerability of vulnerability of women to climate change in each district, the researcher uses the value of the three indices into together and computes the result using the IPCC vulnerability index formula;

$$LVI - IPCC_d = (e_d - a_d) * s_d$$

$$LVI-IPCC \text{ for Debark} = (0.89 - 0.3) * 0.85 \\ = 0.52$$

$$LVI-IPCC \text{ for Dembia} = (0.87 - 0.29) * 0.8 \\ = 0.5$$

$$LVI-IPCC \text{ for West Belesa} = (0.86 - 0.2) * 0.8 \\ = 0.59$$

As illustrated in the above calculation climate vulnerability is higher in all three districts. The maximum vulnerability is observed in West Belesa District (0.59) followed by Debark District (0.52) and the list is scored in Dembia district (0.5). The weighted value of Exposure, Adaptive capacity and Sensitivity result for the three districts were calculated and the average value is identified to calculate the vulnerability of the study area together. As a result the total vulnerability index of the research is;

$$LVI-IPCC_d = (e_d - a_d) * s_d \\ = (0.87 - 0.26) * 0.84 \\ = 0.52$$

According to IPCC the value of vulnerability index lies between -1 and 1 where, -1 is the least vulnerability and 1 is the highest vulnerability result. This shows that women are highly vulnerable to climate change in the study area. Among the three contributing factors the exposure index and sensitivity index the highest and the adaptive capacity index is the least as compare to exposure and sensitivity index.

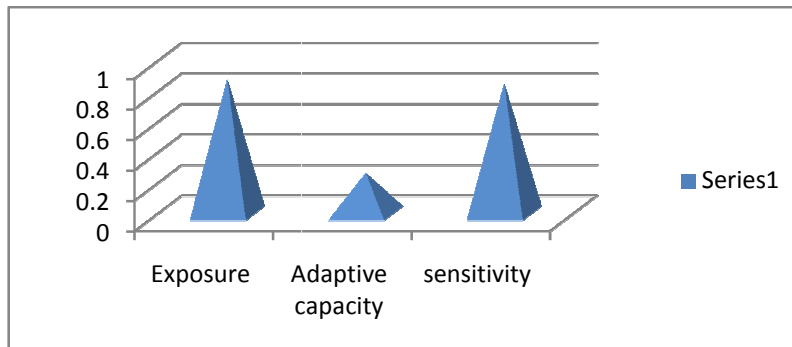


Figure 5 shows the Value of the weighted average result of three indices

Discussion:

Women vulnerability to climate change is measured through the indices the three contributing factors to climate change (exposure, Adaptive capacity and Sensitivity) (IPCC, 2013). This indices are composed of eleven major components which are used as a tool, to collect data from the respondents in the study area. The result of the study reveals that the women exposure climate change is higher in the three districts or study area.

Similarly the adaptive capacity of women to climate change is minimal based on the result shown in figure 2. Among the adaptive capacity social network is among the best practice used by women as coping mechanisms to their climate change induced problems. In fact, different livelihood strategies such as economic activities other than agriculture, access to credit service, knowledge about climate change and its impact and the adaptation techniques are among the methods implemented by women in the study area. According to the research done by Tschakert (2007), in sub- Sahel African countries, reveals that knowledge about the climate change and its impact are enhancing their adaptive capacity and peoples' ability to implement response option is the best way and the prerequisite for climate change adaptation techniques.

The sensitivity measure of the result shows that women are highly sensitive to climate change effects. Health vulnerability, food insecurity, water insecurity and denial to access to education are some the effects of climate change on women observed in the study area. This finding is similar with the research result done in Senegal. It explain the adverse human impacts of drying trends included declining quantity and quality of food, early aging, poverty, outmigration and several health outbreaks, including malaria, bilharzias, and cholera, economic and infrastructure losses, and animal deaths (Tschakert , 2007).

The overall result of the research reveals that women are vulnerable to climate change through the three major components or indexes. The exposure and sensitivity measure of the research higher in the study area meaning there is a tendency to put women in to climate change hazards and risks.

Conclusion and Recommendations:

This paper has presented the methodology for assessing vulnerability women to climate-change, from the perspective of Exposure, Adaptive capacity and Sensitivity indices. Eleven major components were included to measure the value of the three contributing factors. It identifies that women are vulnerable to climate changes through the three contributing factor indices. High exposure

and sensitivity measures are observed while the adaptive capacity is still less. Among the districts, higher exposure value in Debark district, higher sensitivity West Belesa and higher adaptive capacity in Debark are seen in this research paper.

As a recommendation, it is better to enhance the knowledge, skill and attitude of the people to protect and preserve resources and even to use effectively. It must be planned to enhance the awareness level and knowledge to the different adaptive capacity and coping mechanism, and the way how to use and cope up challenges. The policy makers are also expected to include the issues of women in the design, implementation and evaluation of environmental, natural resource and climate related policies, projects and programs.

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